THE WEATHER AND CIRCULATION OF APRIL 1955[1]

Another Cold Month in the West

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1. TEMPERATURE AND CIRCULATION

During April 1955 subnormal temperatures continued for the fifth consecutive month in the western third of the nation. Negative departures as large as 4° F. extended from border to border with an extreme departure of 9° F. occurring in central Oregon (Chart 1B). As a result this month was one of the coldest Aprils on record in the Pacific Northwest, where temperatures were more characteristic of March than April. On individual days minimum temperatures dropped as low as 24° F. at Prescott, Ariz., 28° at Medford, Oreg., and 31° at Fresno, Calif. Frosts accompanying these cold spells were particularly damaging, especially in the Sacramento Valley of California.

This unusually cold weather resulted from the frequent influx of cold fresh maritime Polar air masses with a short fetch from the Gulf of Alaska which were driven inland by the circulation around a stronger than normal upper level anticyclone in the eastern Pacific (fig. 1). The abnormal strength of this onshore flow is indicated by the large anomaly gradient between the +260-ft. center near 40° N., 160° W. and a −220-ft. center in the Gulf of Alaska (fig. 1). Average wind speeds at the 700-mb. surface ranged from 17 m. p. s. over the Pacific to 10 m. p. s. across the west coast (fig. 2A), which represented speeds from 8 to 6 m. p. s. above normal (fig. 2B). The unusual coldness of these air masses is apparent from figure 3 where a negative thickness anomaly (1000–700 mb.) of more than 100 ft. covered Alaska, the northeast Pacific, and the Pacific Northwest.

While cold weather in the West during March persisted into April, this was not so in the Northern Plains, Great Lake States, and the Northeast. Here subnormal temperatures of March gave way to abnormally warm temperatures during April. In Minnesota, for example, the temperature anomaly changed from −8° F. in March to +8° F. in April. This strong warming accompanied a large increase in height of the 700-mb. surface over Hudson Bay, the Northern Plains, and Great Lakes as successive blocking waves influenced the area, resulting in a positive 700-mb. height anomaly of 290 ft. (fig. 1) and positive sea-level anomaly of 8 mb. in northeastern Canada (Chart XI and inset). These anomalies, in turn, were accompanied by a strong southerly anomalous component of flow having a long fetch from the lower Mississippi Valley north-northwestward into the Arctic.

Monthly mean temperatures also averaged above normal in southern United States as a result of prevailing southerly flow at sea level (Chart XI) and above normal heights of the 700-mb. surface (fig. 1). Afternoon temperatures during the month rose into the 90's as far north as Chattanooga and to 102° F. in the Rio Grande Valley.

2. PRECIPITATION

Precipitation accompanying the maritime invasions of the western States was unusually abundant, particularly in Washington and Oregon, where monthly amounts as high as 14.33 inches were reported (Charts II and III). This precipitation was distributed over a large part of the month with Portland, Oreg., for example, reporting 22 days with measurable rain, the second highest on record for April. More than twice the normal amount fell in eastern Oregon where Burns experienced 17 days with 0.01 inch or greater as compared with an average of about 4 days for the month. Furthermore, during the last 15 days of the month at least a trace of precipitation occurred on every day at Burns. In California the first heavy rains since January ameliorated the drought conditions that had developed. Some of the interior regions reported late season snowfalls. Salt Lake City, for example, received an April record fall of 12.8 inches early in the month and 5 inches more later on.

Important, though not independent, factors relating this precipitation to the monthly circulation were: (1) cyclonically curved flow occurring in connection with the mean trough along the coast, (2) below normal 700-mb. heights, (3) stronger than normal onshore flow of Pacific maritime air masses with forced ascent over the mountains, (4) frequent cyclonic activity at sea level (Chart X).

Precipitation in the Northern Plains was associated with a mean trough to the lee of the Rockies accompanied by below normal sea level pressures and 700-mb. heights (Chart XI and fig. 1). The accumulated amounts varied from about a half inch in the Dakotas to 4½ inches in Montana. Storminess responsible for this precipitation

[1] See Charts I–XV following p. 101 for analyzed climatological data for the month.

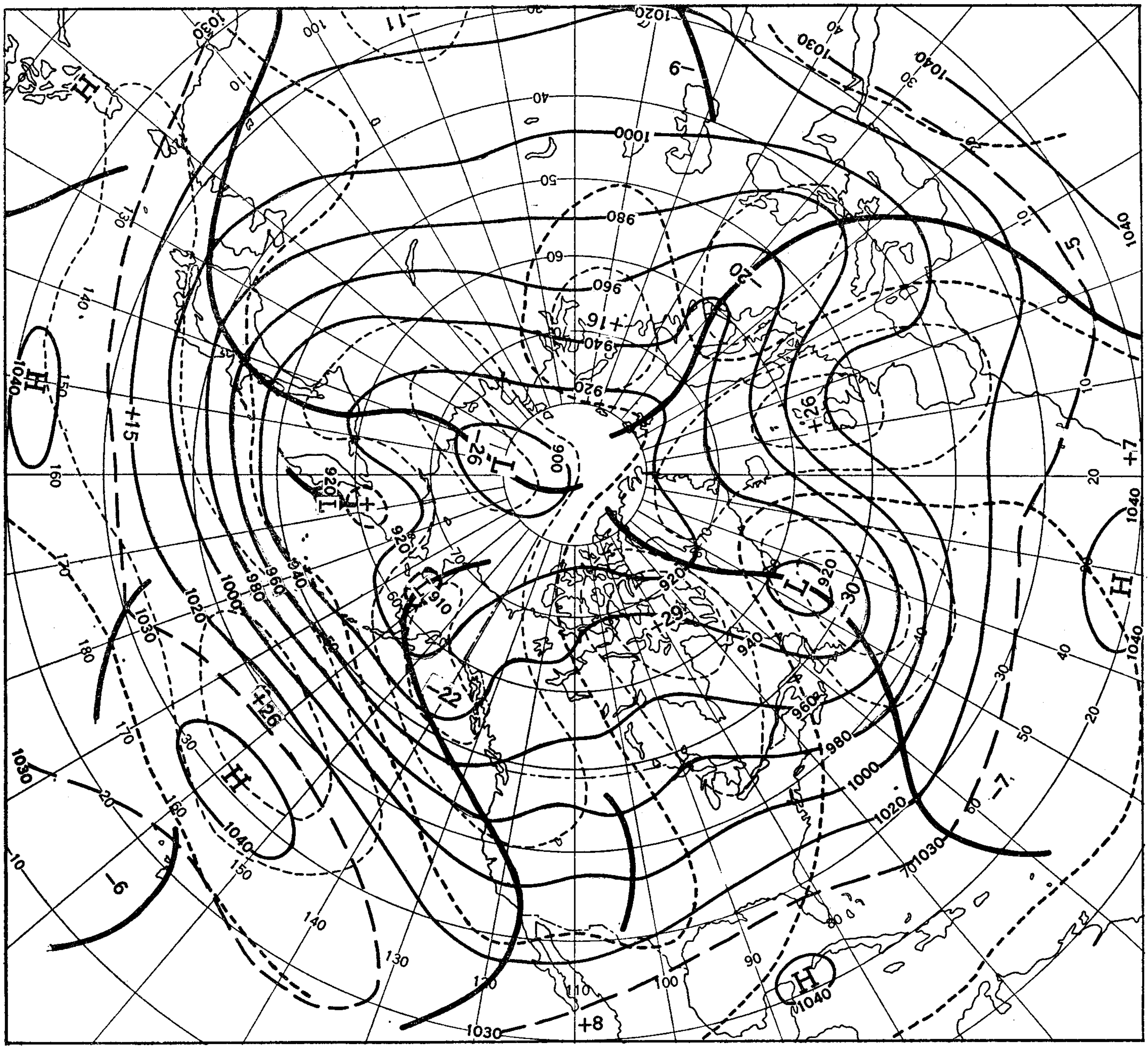


FIGURE 1.—Mean 700-mb. contours and height departures from normal (both in tens of feet) for April 1955. Important features for North American weather were the troughs in the west with below normal heights and the ridge in the east with blocking activity in northeastern Canada.

was frequent (Chart X) and displayed a tendency toward a 4-day periodicity, especially during the latter half of the month. Considering the number of storms, the amounts of precipitation in the Dakotas appear surprisingly small. While precipitation in the Dakotas was much less than in Montana, it was more evenly distributed throughout the month. For example, Fargo with a total of only 0.48 inch experienced 10 days of measurable precipitation as contrasted with Billings, where about nine times as much accumulated (4.42 inches) over only 6 days. In fact, by April 4 Billings had already received 93 percent of its monthly total.

Drought conditions continued in the Southern Plains, further depleting the already deficient soil moisture. This dryness was essentially in the nature of a "rain-shadow" caused by strong flow of Pacific air over the southern Rockies, where average wind speeds were 2–4 m. p. s. stronger than normal (fig. 2A, B). In this area the mean jet was considerably south of its position during March. This southward displacement was associated with a strong

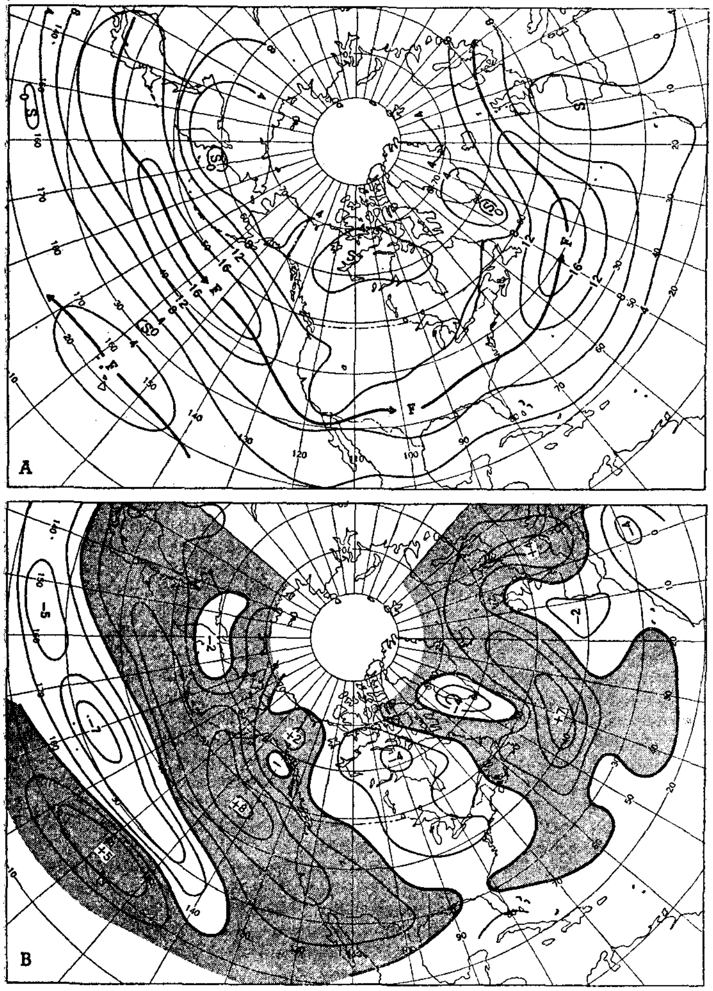


FIGURE 2.—(A) Mean 700-mb. isotachs and (B) departure from normal wind speed (both in meters per second) for April 1955. Solid arrows indicate position of mean 700-mb. jet stream which was situated south of its normal position in the United States.

northwest-southeast tilt of the trough off the west coast (fig. 1) as momentum was periodically transferred southward.

The heaviest precipitation in the country occurred over the Southeast, where amounts of 17.69 inches fell at Mobile, Ala., and 12.29 inches at Memphis, Tenn. Most of the rainfall at Mobile occurred on the 13th when 13.36 inches or 75 percent of the monthly total was reported. At Memphis, however, the rainfall was more uniformly distributed. These rains represented, on the one hand, relief from drought along the Gulf Coast, and, on the other hand, a continuation of the rainy spell that characterized March in the northern part of these States and in Tennessee. Moisture for this precipitation was carried onshore from the Gulf of Mexico at low levels (Chart XI), and probably released by the vertical circulations accompanying the mean jet stream in the South (fig. 2A).

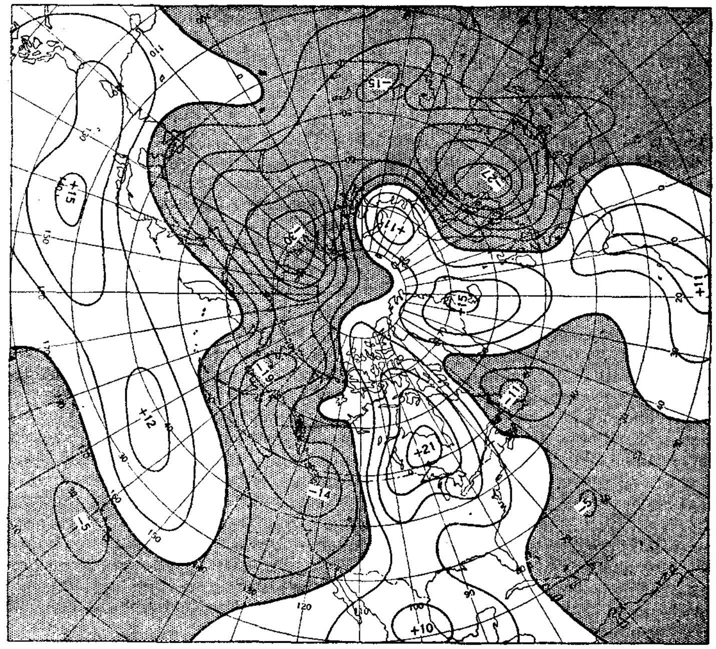


FIGURE 3.—Mean thickness anomaly (tens of feet) for the layer between 1000 and 700 mb. for April 1955. Isopleths are drawn at 50-ft. intervals and negative areas shaded. Unusually cold air in the northeastern Pacific was the source for the extremely cold weather in the West.

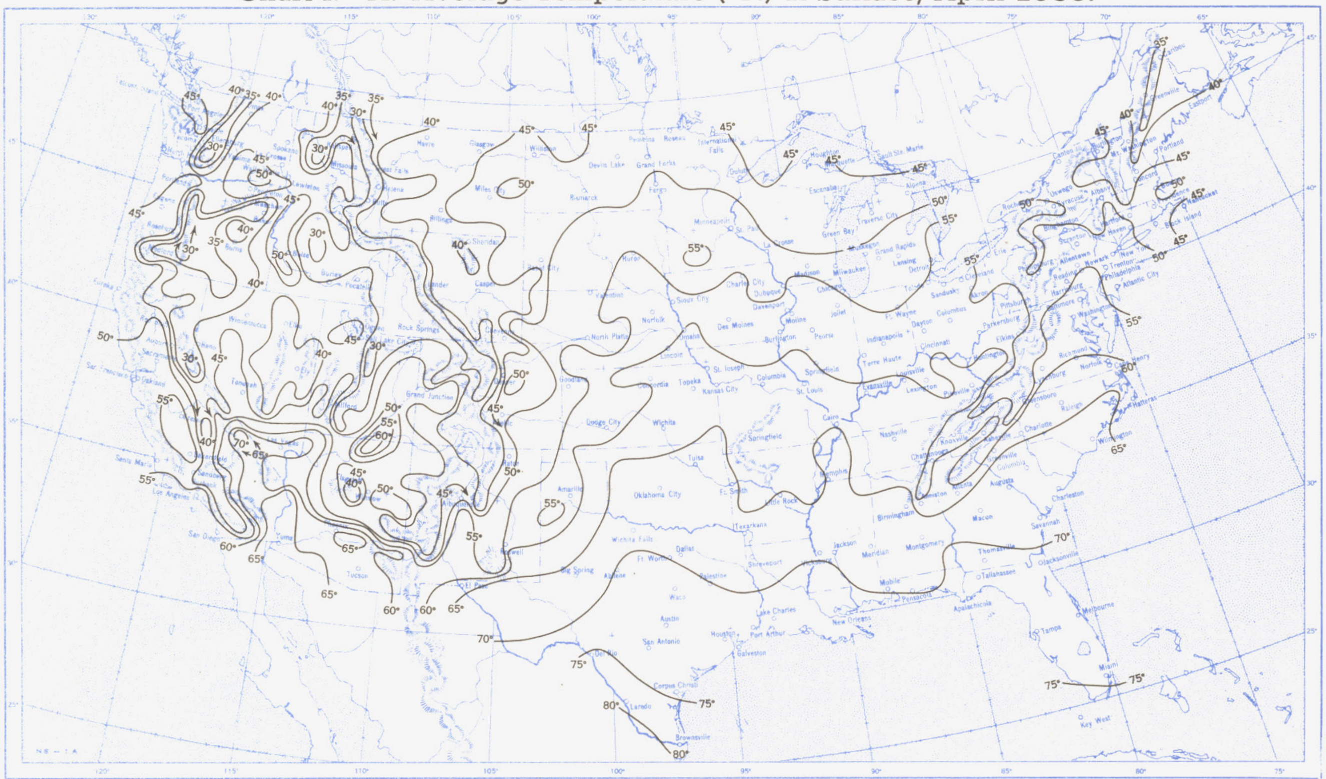
3. SOME CIRCULATION FEATURES IN OTHER PARTS OF THE HEMISPHERE

Off the east coast of North America heights of the 700-mb. surface were 300 ft. below normal, accompanying a 9,200-ft. closed low center south of Greenland. Storminess here was frequent throughout the month (Chart X), with most of the cyclones occurring north of the strongest band of winds at 700 mb. (fig. 2A) and the region of greatest cyclonic vorticity.

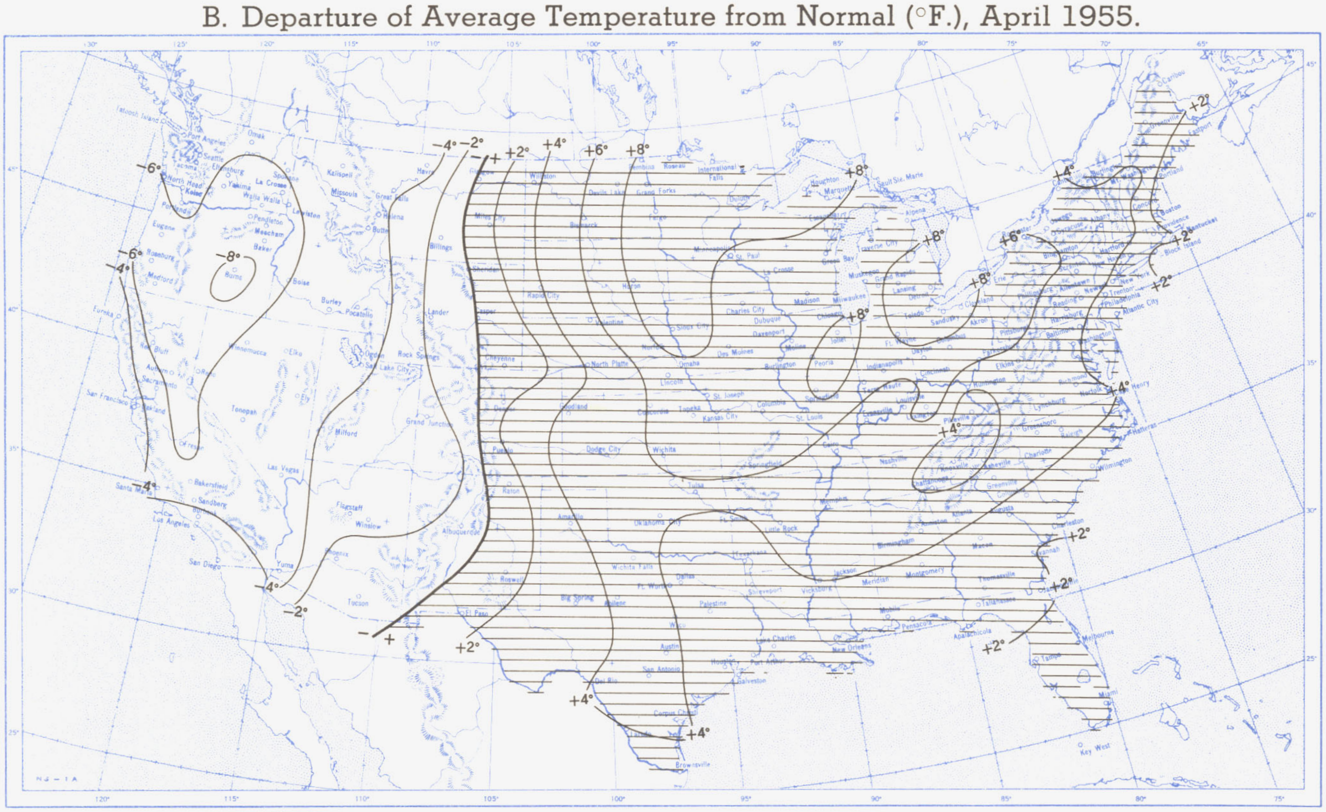
Bounding this region of subnormal heights was an elongated area of positive anomalies extending from northeastern Canada across Greenland, Iceland, and the British Isles to southwestern Europe. These positive anomalies were indicative of frequent blocking activity that characterized the circulation of this portion of the hemisphere. Anticyclonic activity over the British Isles was particularly well marked, resulting in a closed surface high center and strong 700-mb. ridge on the monthly mean (fig. 1), with predominantly sunny skies and dry weather.

East of the ridge a deep trough was located in central Europe with heights 200 ft. below normal. This was accompanied by extremely cold air, as indicated by the mean thickness anomaly of −270 ft. (fig. 3). Similarly very cold temperatures (−300 ft.) were indicated in northeastern Siberia, accompanying a low center in the Arctic and below normal heights throughout eastern Asia.

Chart I. A. Average Temperature (°F.) at Surface, April 1955.



B. Departure of Average Temperature from Normal (°F.), April 1955.

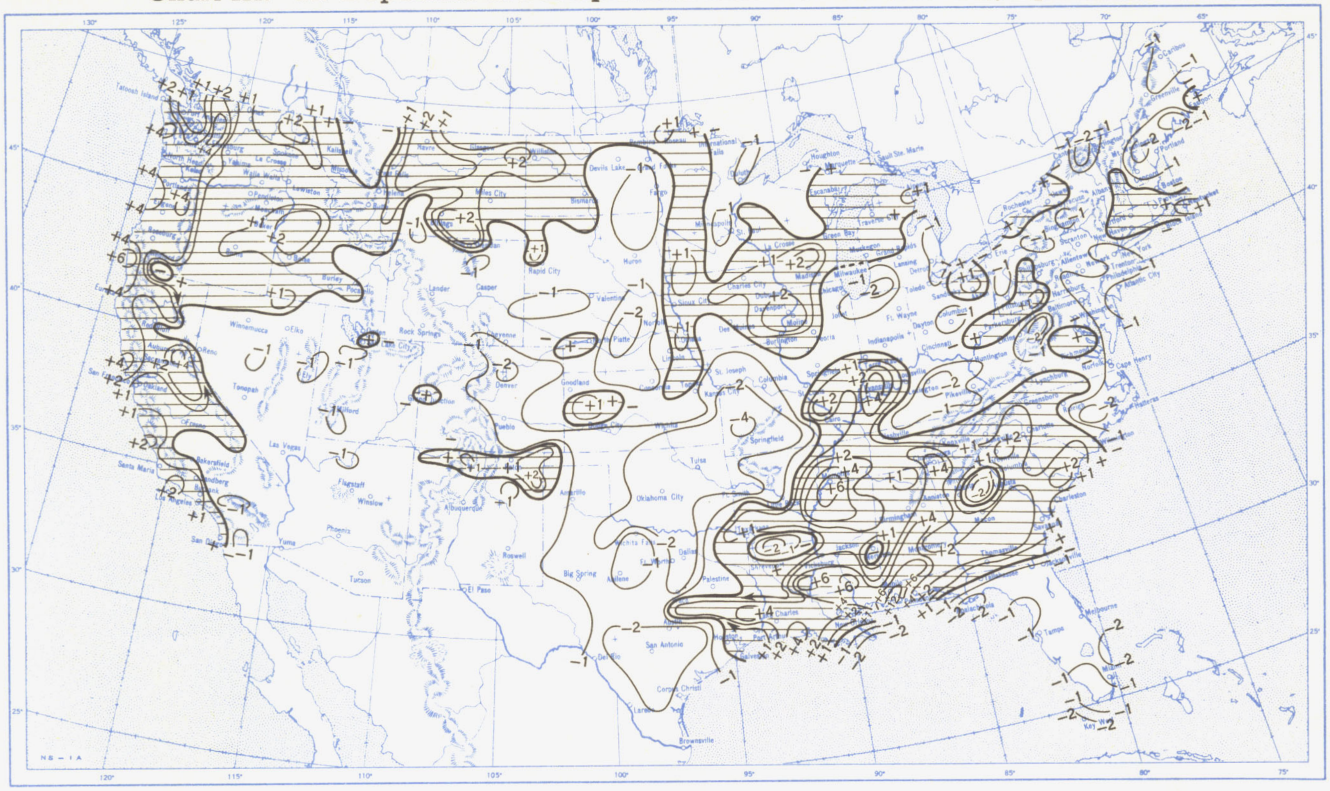


A. Based on reports from 800 Weather Bureau and cooperative stations. The monthly average is half the sum of the monthly average maximum and monthly average minimum, which are the average of the daily maxima and daily minima, respectively.
B. Normal average monthly temperatures are computed for Weather Bureau stations having at least 10 years of record.

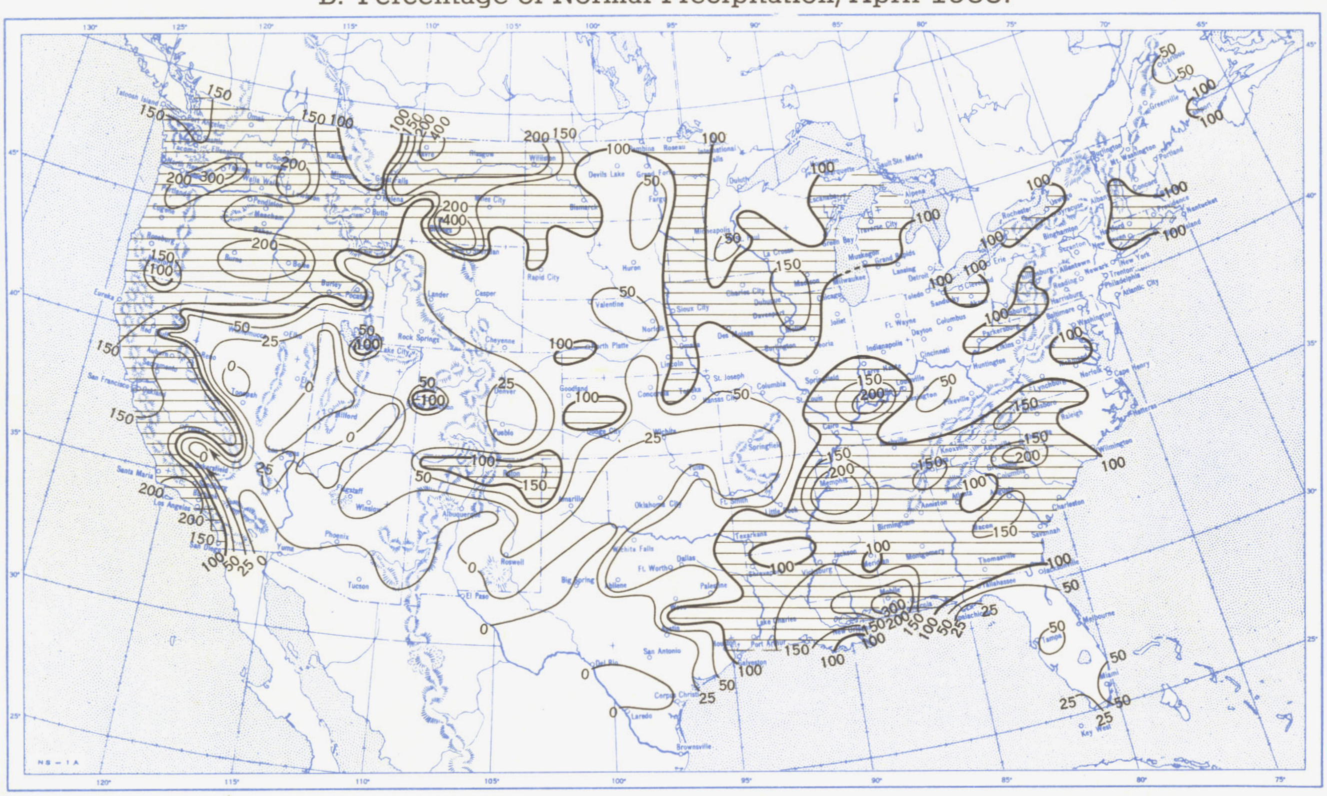
Chart II. Total Precipitation (Inches), April 1955.

Based on daily precipitation records at 800 Weather Bureau and cooperative stations.

Chart III. A. Departure of Precipitation from Normal (Inches), April 1955.



B. Percentage of Normal Precipitation, April 1955.

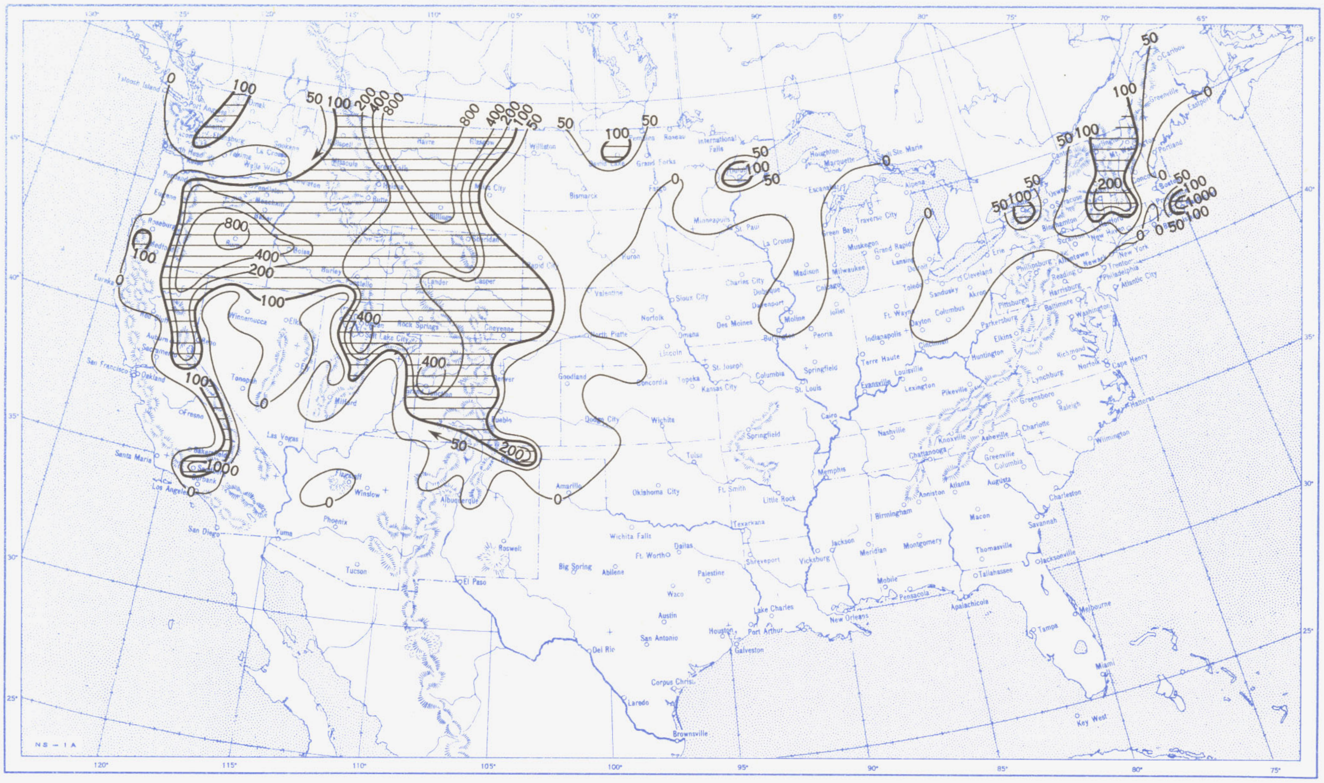


Normal monthly precipitation amounts are computed for stations having at least 10 years of record.

Chart IV. Total Snowfall (Inches), April 1955.

This is the total of unmelted snowfall recorded during the month at Weather Bureau and cooperative stations. This chart and Chart V are published only for the months of November through April although of course there is some snow at higher elevations, particularly in the far West, earlier and later in the year.

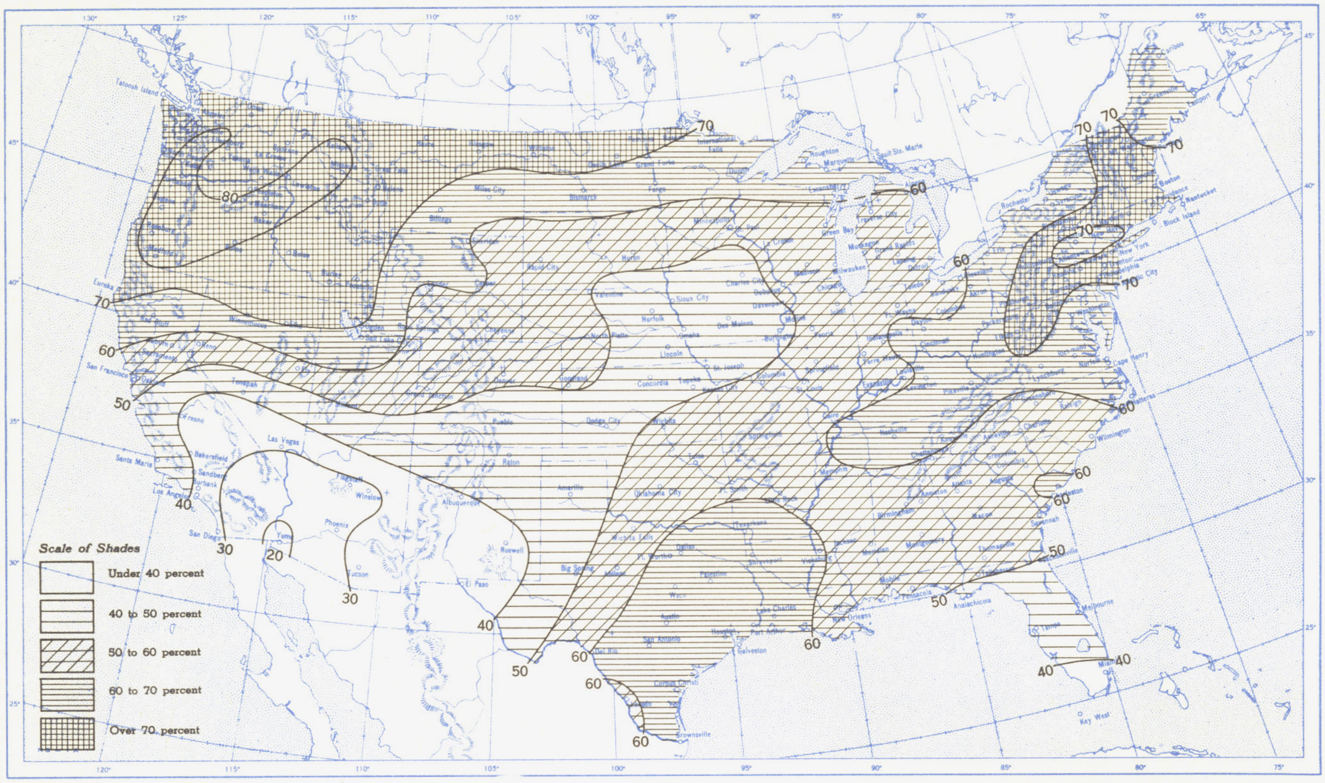
Chart V. A. Percentage of Normal Snowfall, April 1955.



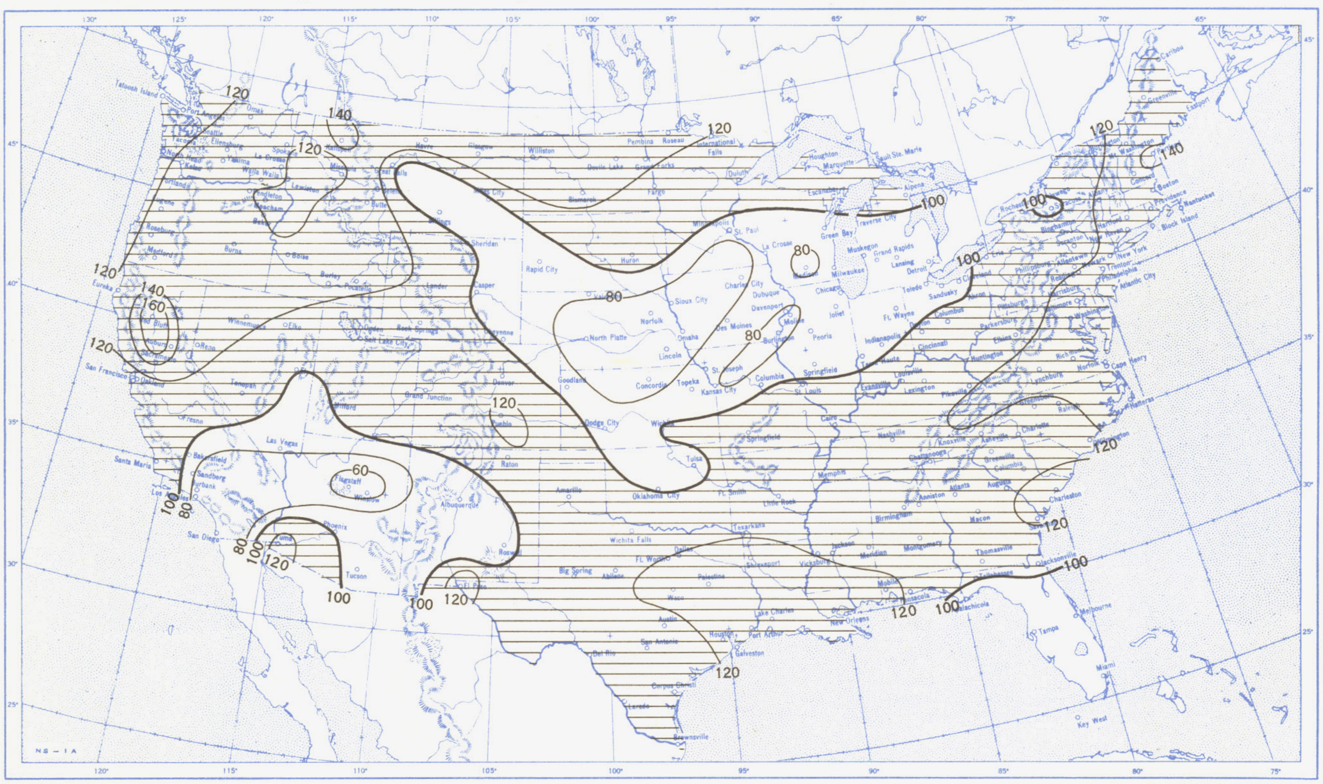
B. Depth of Snow on Ground (Inches). 7:30 a. m. E. S. T., April 25, 1955.

A. Amount of normal monthly snowfall is computed for Weather Bureau stations having at least 10 years of record.
B. Shows depth currently on ground at 7:30 a. m. E. S. T., of the Tuesday nearest the end of the month. It is based on reports from Weather Bureau and cooperative stations. Dashed line shows greatest southern extent of snowcover during month.

Chart VI. A. Percentage of Sky Cover Between Sunrise and Sunset, April 1955.

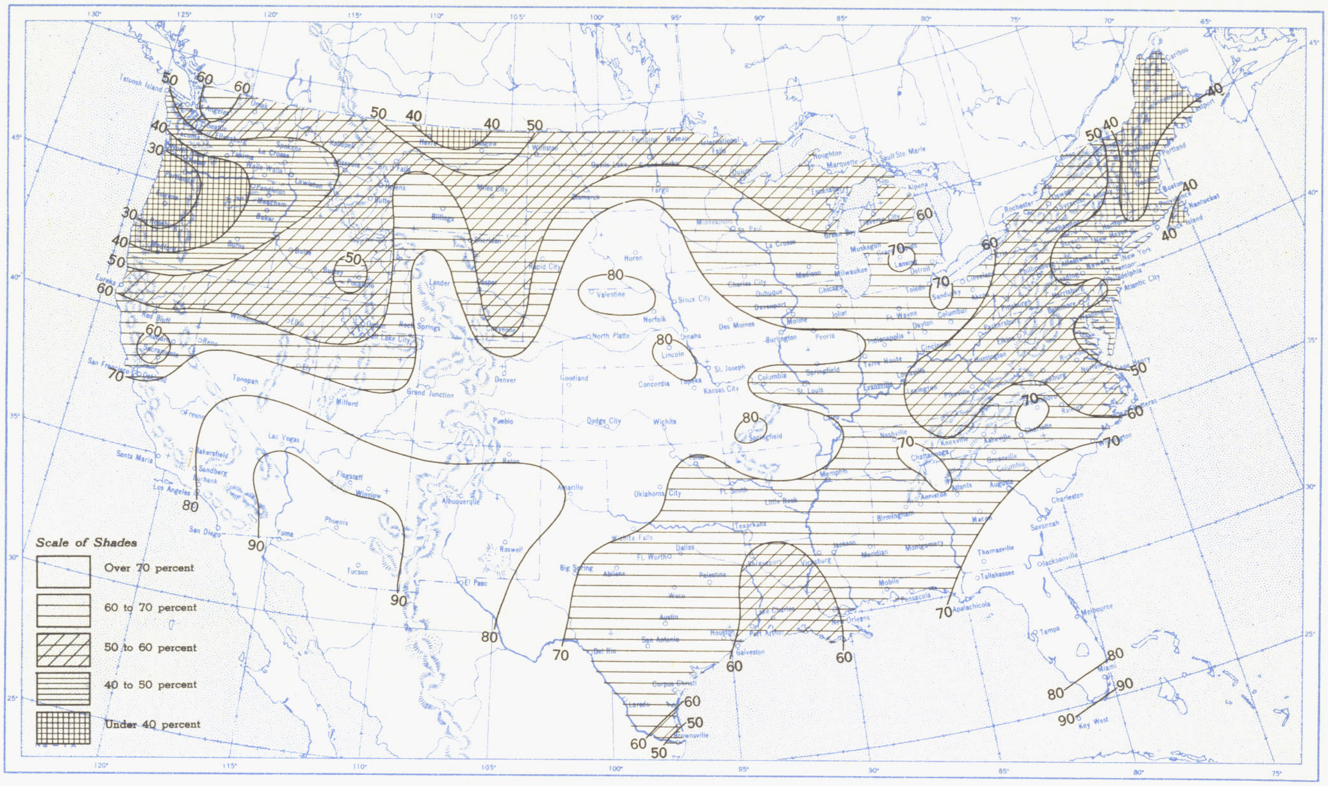


B. Percentage of Normal Sky Cover Between Sunrise and Sunset, April 1955.

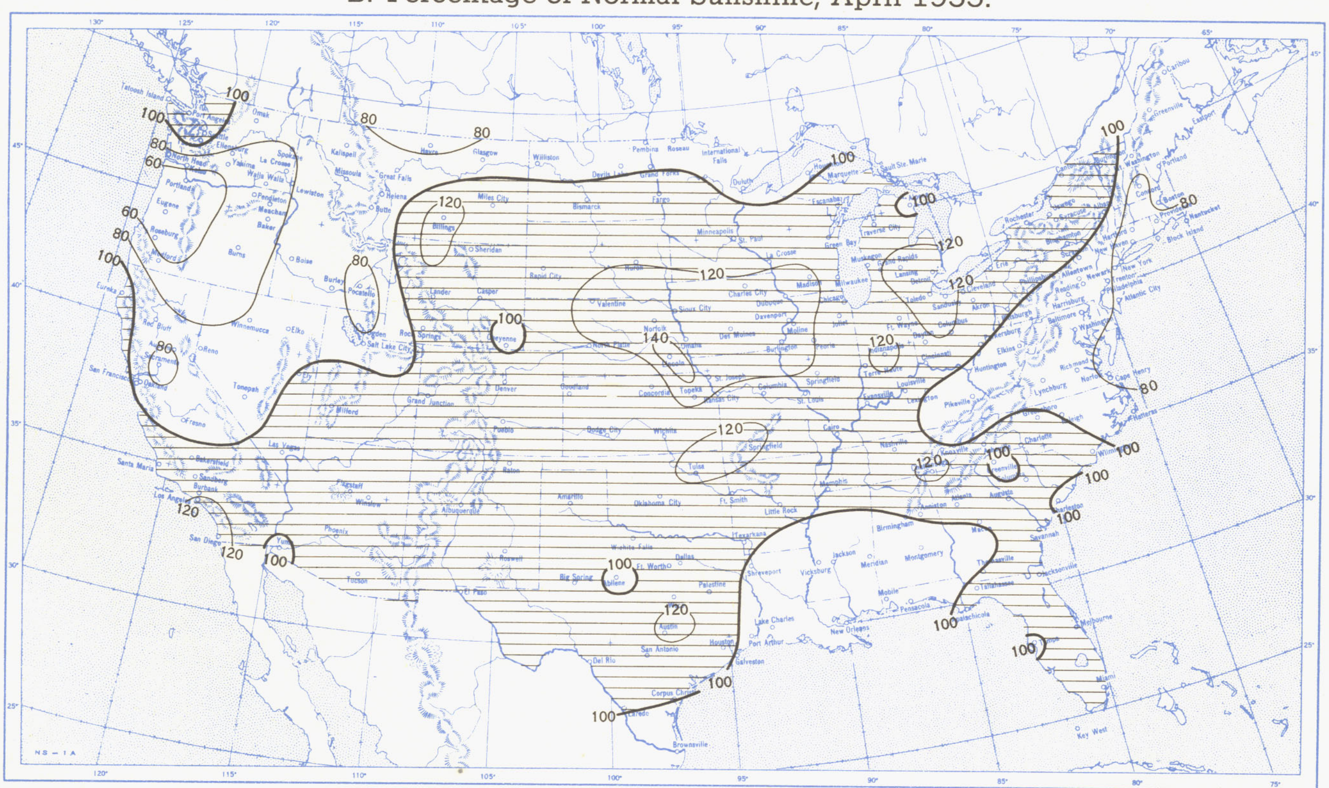


A. In addition to cloudiness, sky cover includes obscuration of the sky by fog, smoke, snow, etc. Chart based on visual observations made hourly at Weather Bureau stations and averaged over the month. B. Computations of normal amount of sky cover are made for stations having at least 10 years of record.

Chart VII. A. Percentage of Possible Sunshine, April 1955.



B. Percentage of Normal Sunshine, April 1955.



A. Computed from total number of hours of observed sunshine in relation to total number of possible hours of sunshine during month. B. Normals are computed for stations having at least 10 years of record.

Chart VIII. Average Daily Values of Solar Radiation, Direct + Diffuse, April 1955. Inset: Percentage of Normal Average Daily Solar Radiation.

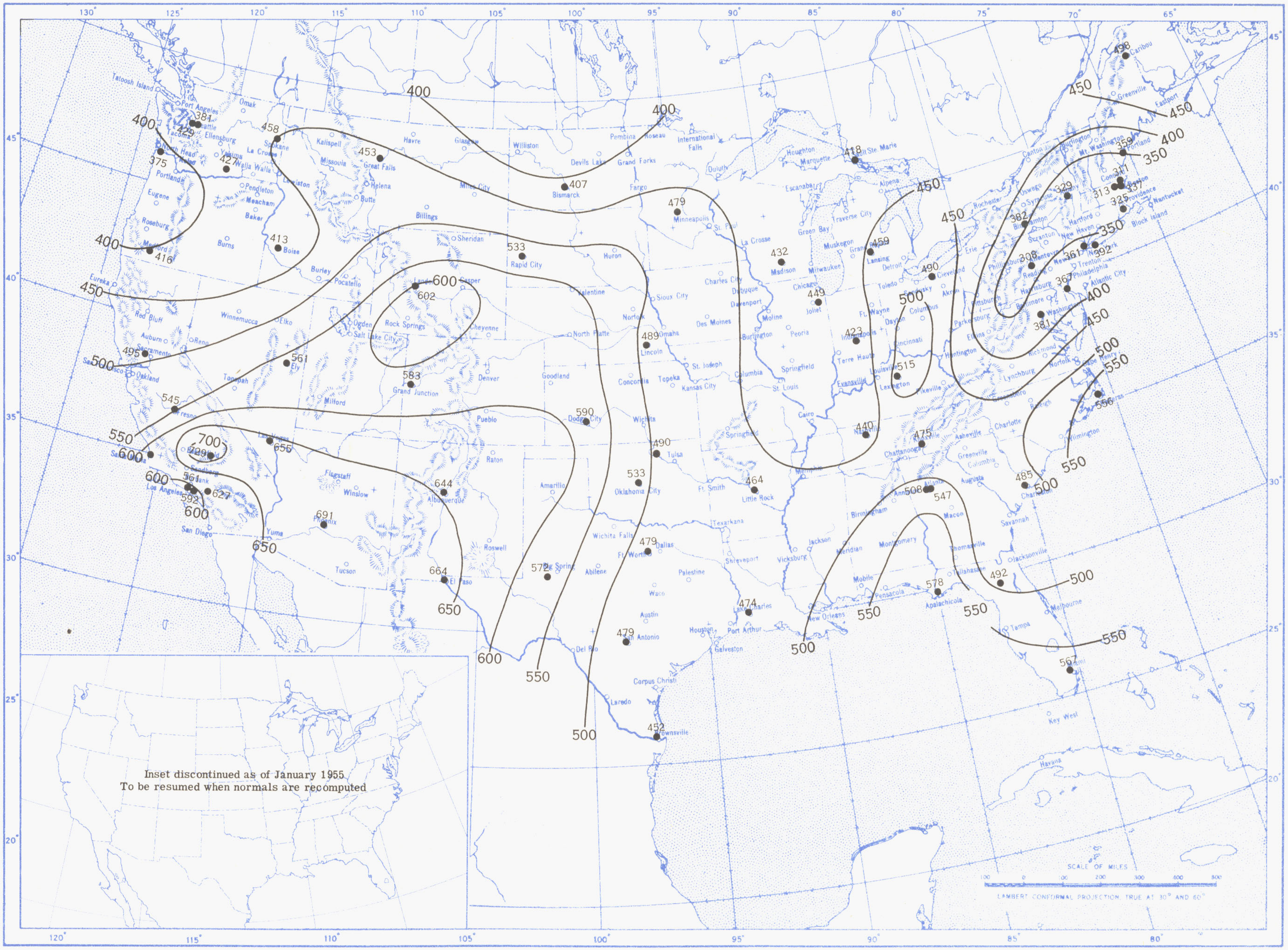
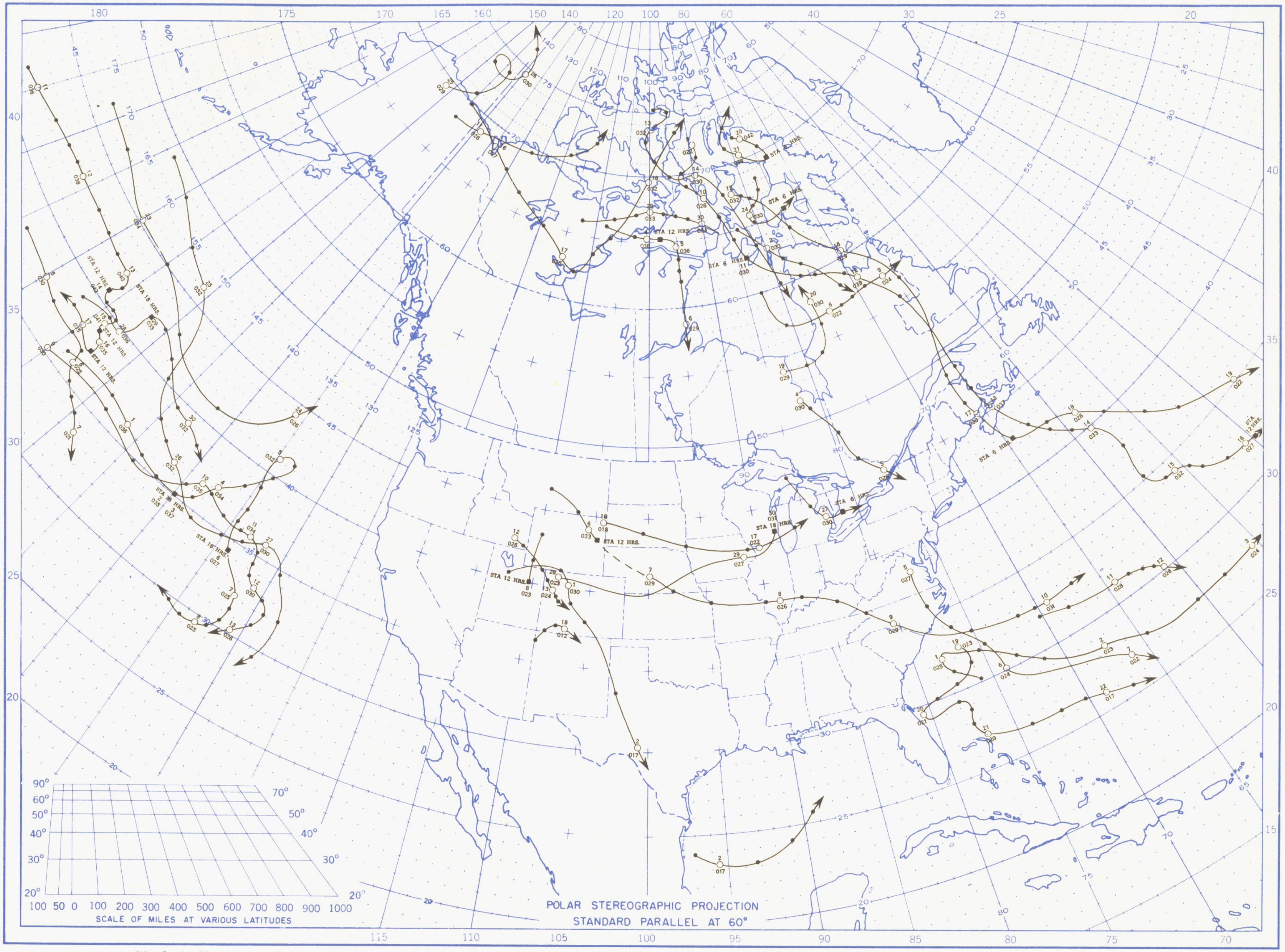


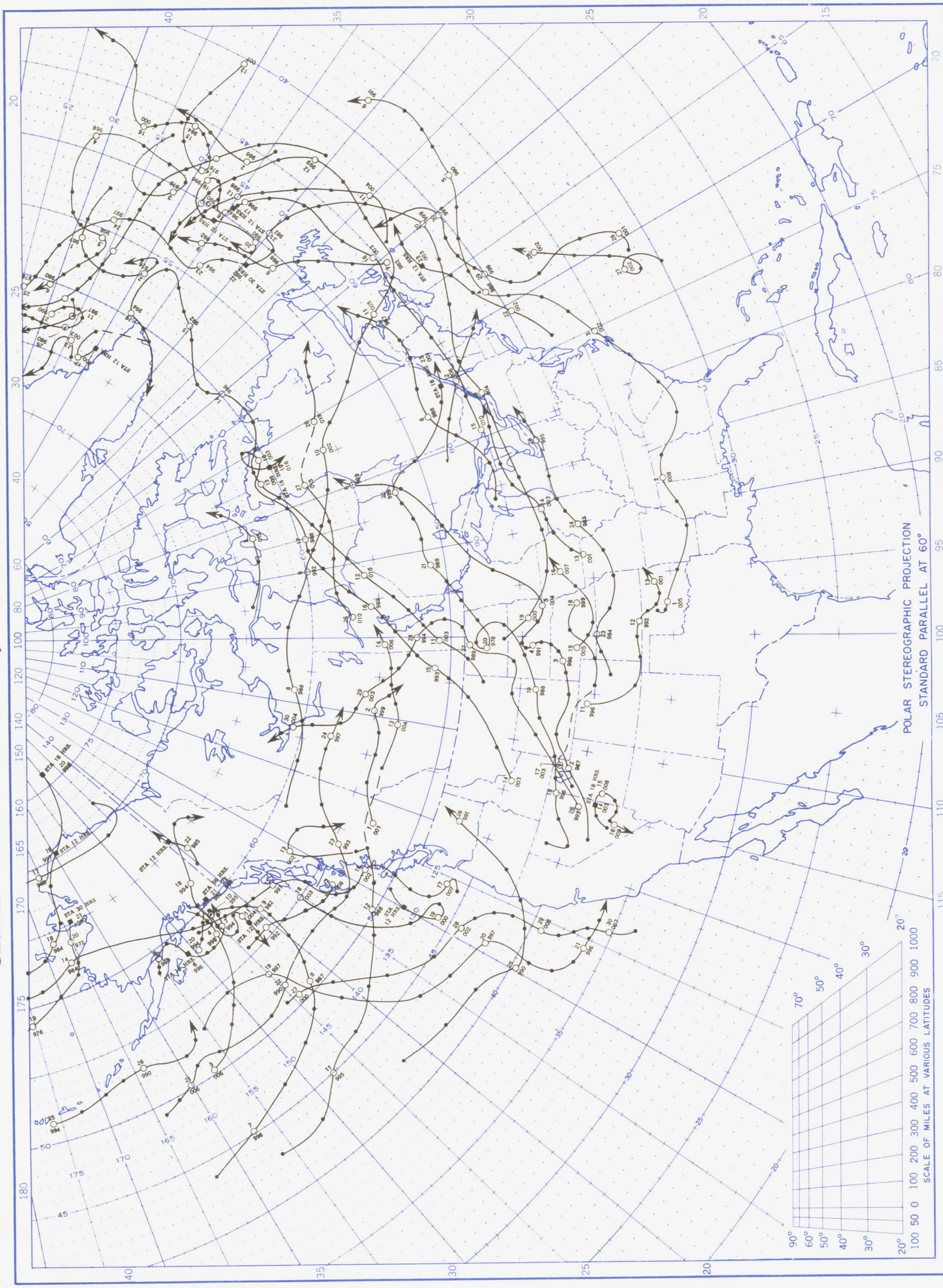
Chart shows mean daily solar radiation, direct + diffuse, received on a horizontal surface in langleys (1 langley = 1 gm. cal. cm. $^{-2}$). Basic data for isolines are shown on chart. Further estimates are obtained from supplementary data for which limits of accuracy are wider than for those data shown.

Chart IX. Tracks of Centers of Anticyclones at Sea Level, April 1955.



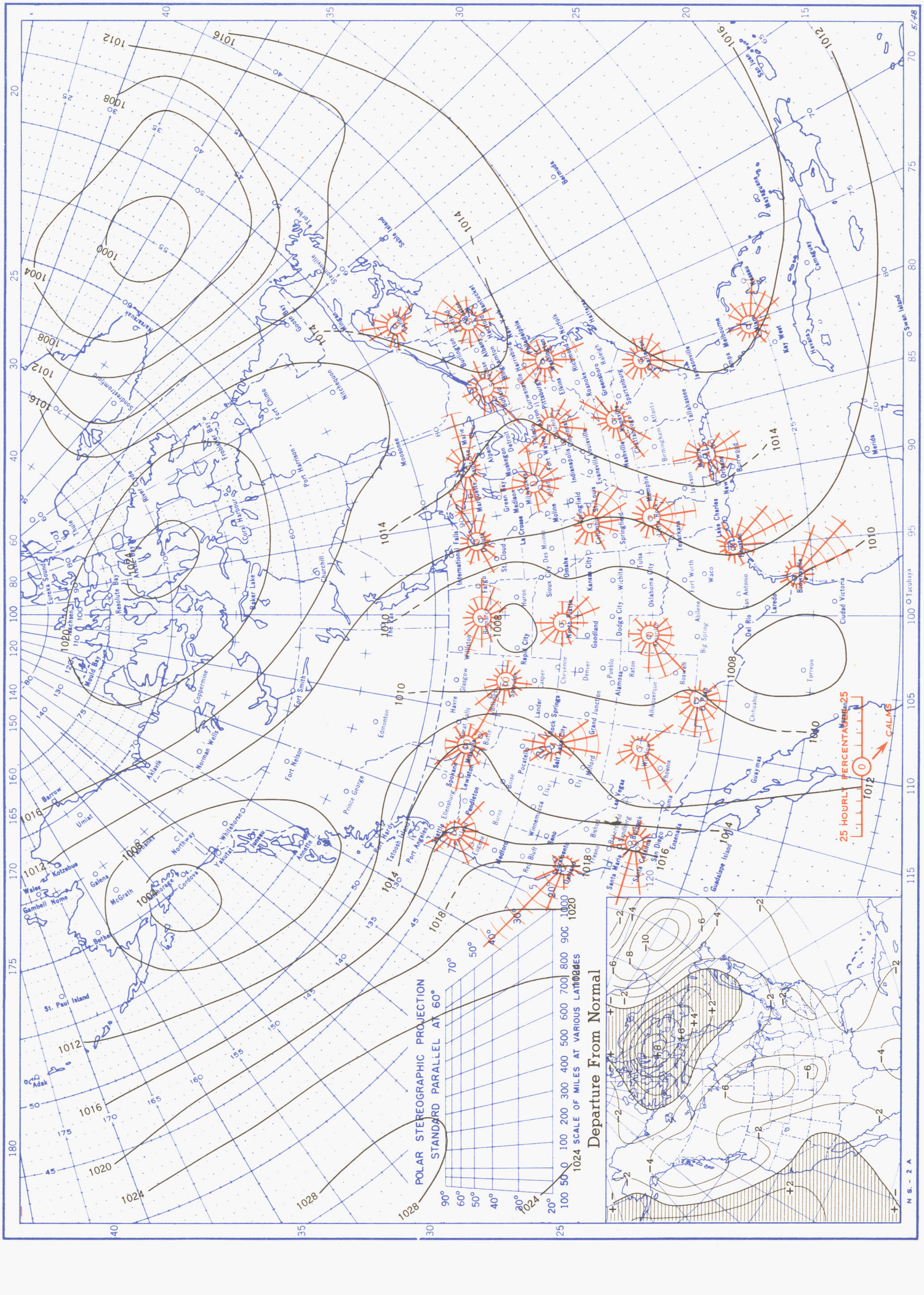
Circle indicates position of center at 7:30 a. m. E. S. T. Figure above circle indicates date, figure below, pressure to nearest millibar. Dots indicate intervening 6-hourly positions. Squares indicate position of stationary center for period shown. Dashed line in track indicates reformation at new position. Only those centers which could be identified for 24 hours or more are included.

Chart X. Tracks of Centers of Cyclones at Sea Level, April 1955.



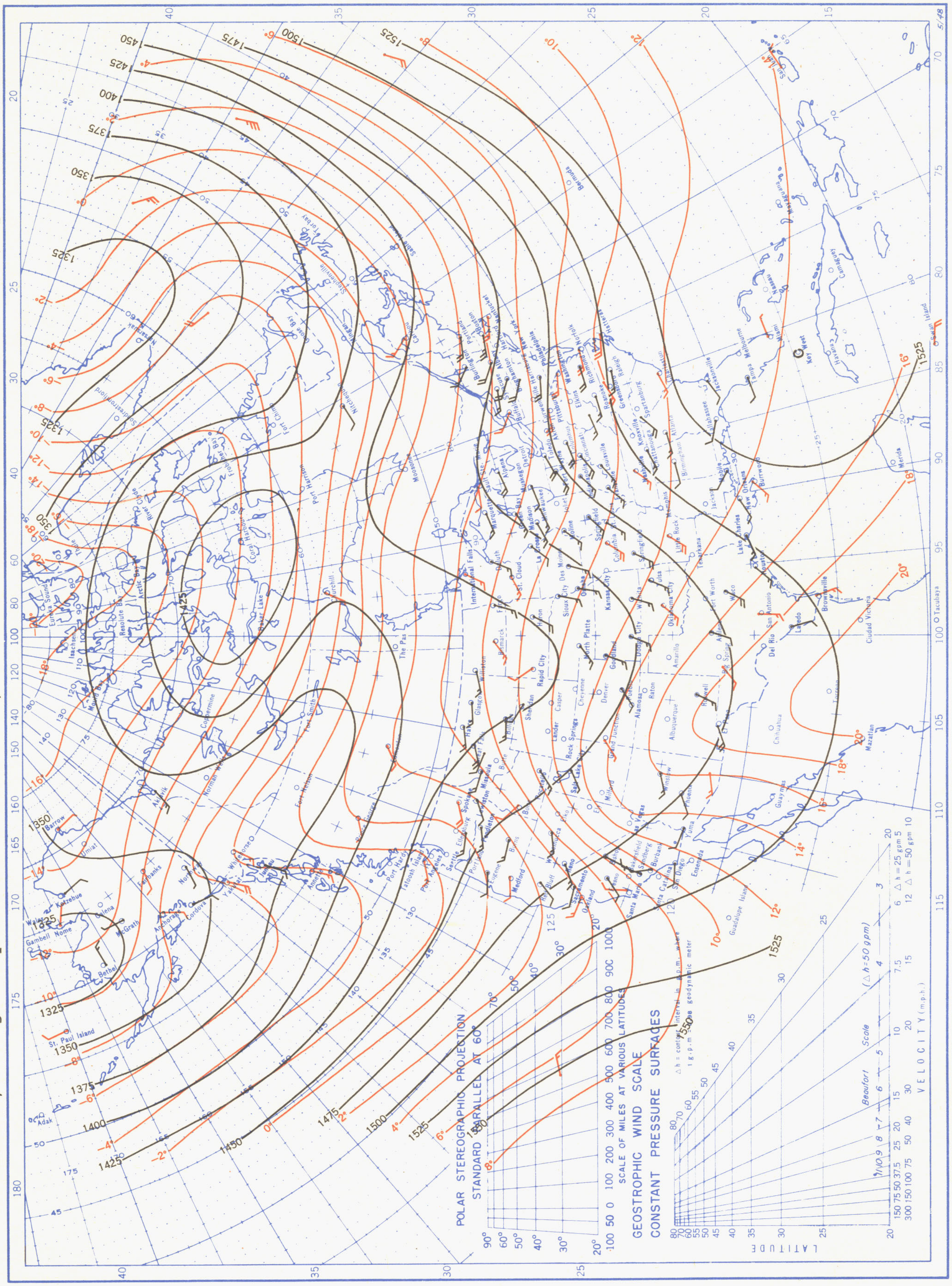
Circle indicates position of center at 7:30 a. m. E. S. T. See Chart IX for explanation of symbols.

Chart XI. Average Sea Level Pressure (mb.) and Surface Windroses, April 1955. Inset: Departure of Average Pressure (mb.) from Normal, April 1955.



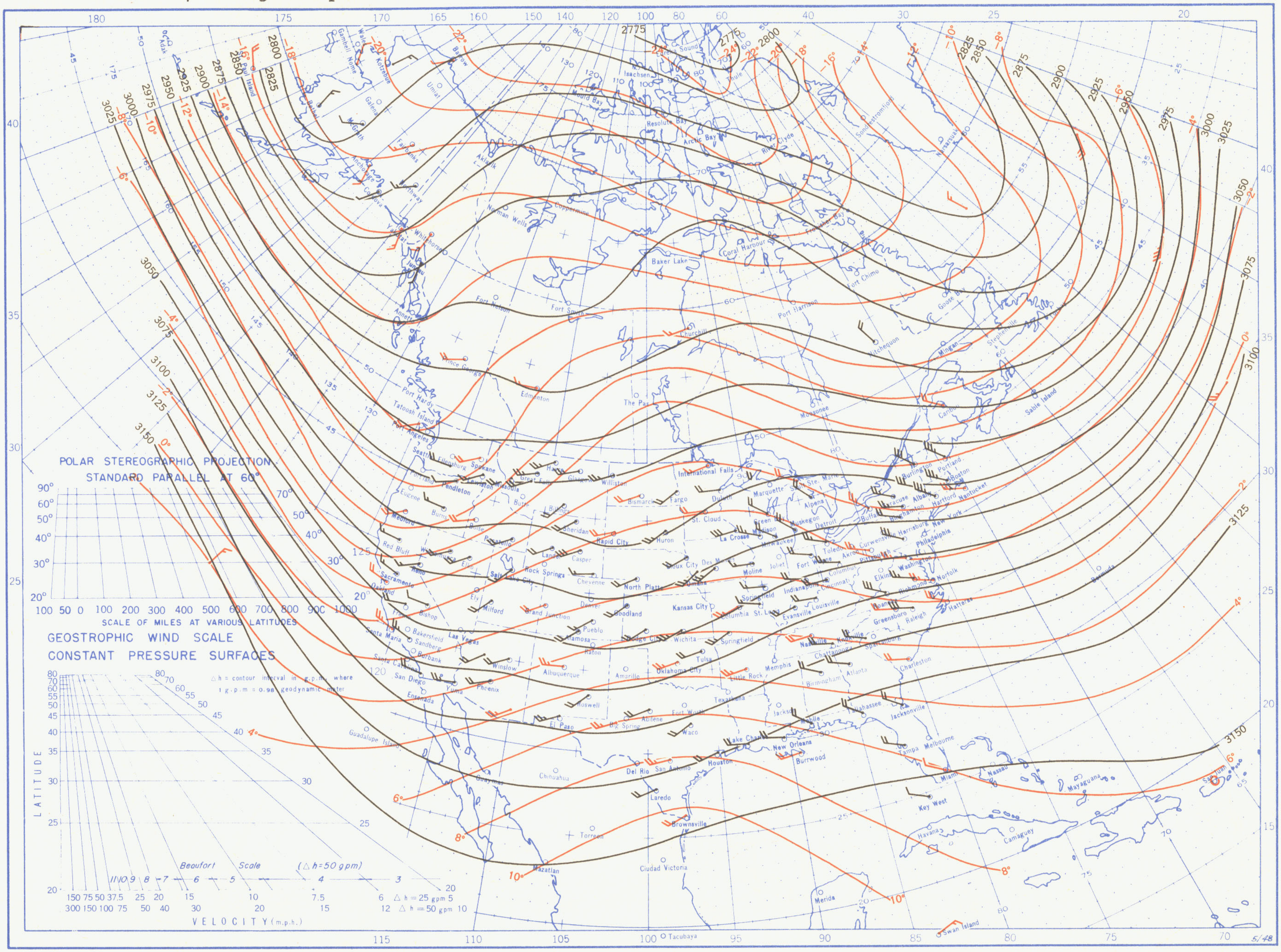
Average sea level pressures are obtained from the averages of the 7:30 a.m. and 7:30 p.m. E.S.T. readings. Windroses show percentage of time wind blew from 16 compass points or was calm during the month. Pressure normals are computed for stations having at least 10 years of record and for 10° intersections in a diamond grid based on readings from the Historical Weather Maps (1899-1939) for the 20 years of most complete data coverage prior to 1940.

Chart XII. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 850-mb. Pressure Surface, Average Temperature in °C. at 850 mb., and Resultant Winds at 1500 Meters (m.s.l.), April 1955.



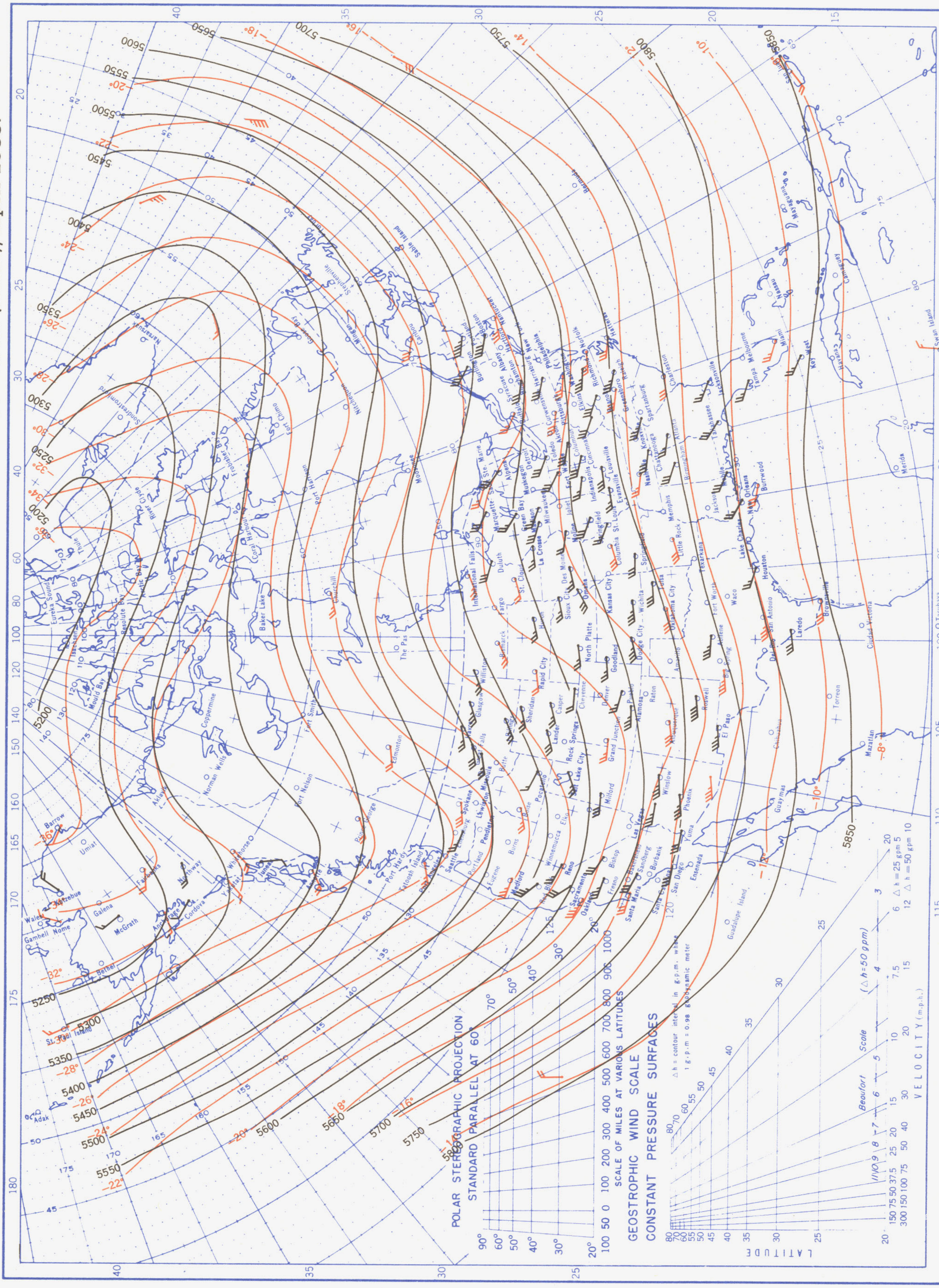
Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins taken at 0300 G. M. T. Wind barbs indicate wind speed on the Beaufort scale.

Chart XIII. Average Dynamic Height in Geopotential Meters (1 g.p.m.. = 0.98 dynamic meters) of the 700-mb. Pressure Surface, Average Temperature in °C. at 700 mb., and Resultant Winds at 3000 Meters (m.s.l.), April 1955.



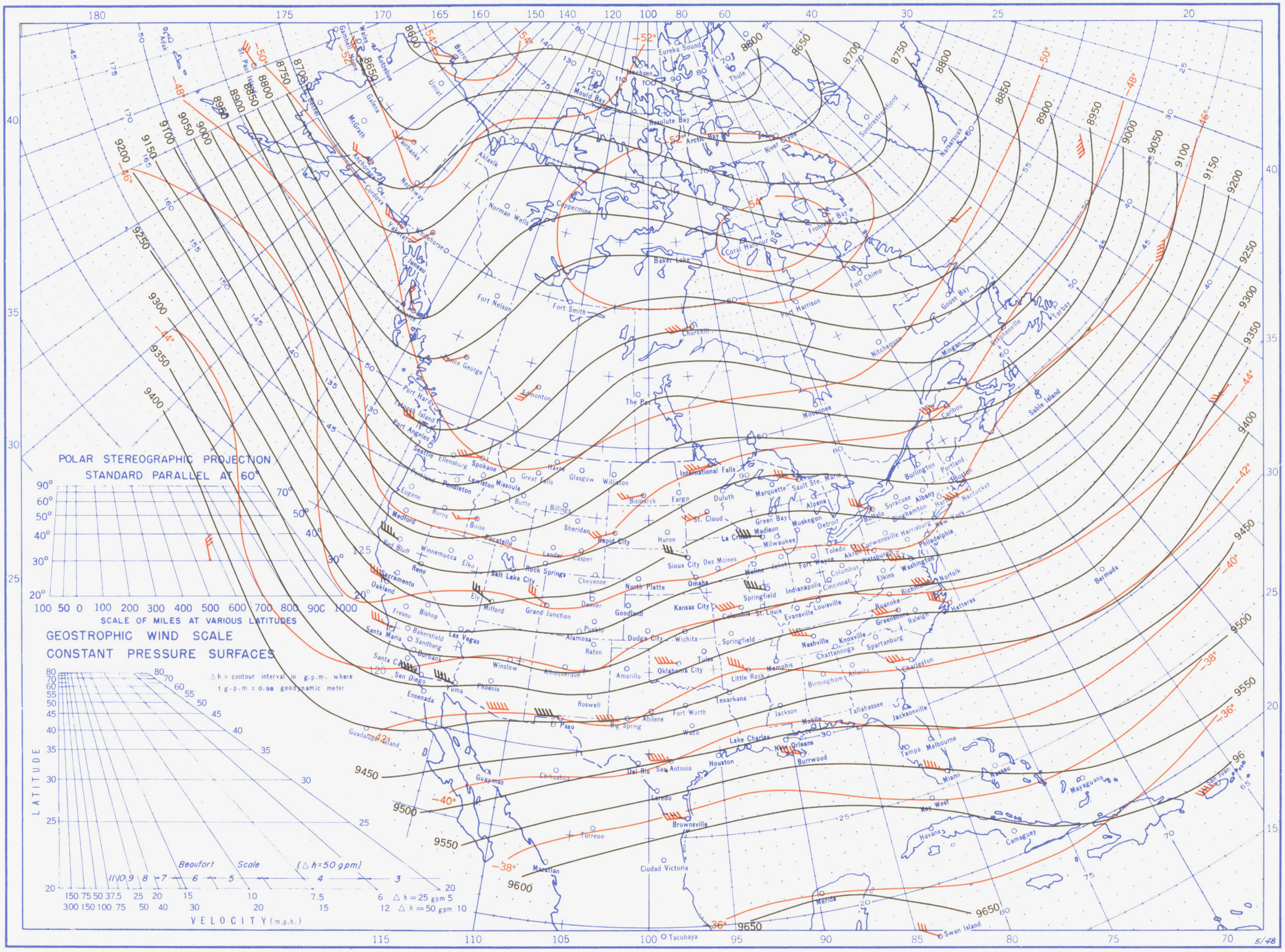
Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins taken at 0300 G. M. T. Wind barbs indicate wind speed on the Beaufort scale.

Chart XIV. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 500-mb. Pressure Surface, Average Temperature in °C. at 500 mb., and Resultant Winds at 5000 Meters (m.s.l.), April 1955.



Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins at 0300 G. M. T. Wind barbs indicate wind speed on the Beaufort scale.

Chart XV. Average Dynamic Height in Geopotential Meters (1 g.p.m. = 0.98 dynamic meters) of the 300-mb. Pressure Surface, Average Temperature in °C. at 300 mb., and Resultant Winds at 10,000 Meters (m.s.l.), April 1955.



Contour lines and isotherms based on radiosonde observations at 0300 G. M. T. Winds shown in black are based on pilot balloon observations at 2100 G. M. T.; those shown in red are based on rawins at 0300 G. M. T. Wind barbs indicate wind speed on the Beaufort scale.